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Seven new records of mosses in Iran

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Abstract

Based on the survey of mosses in West Azerbaijan, Mazandaran and Yazd provinces of Iran, seven species of mosses namely, *Bryum algovicum*, *B. creberrimum*, *B. klinggraeffi*, *B. mildeanu* (Bryaceae), *Grimmia plagiopodia* (Grimmiaceae), *Orthotrichum rivulare* (Orthotrichaceae), and *Didymodon sinuosus* (Pottiaceae) are newly recorded for the Iranian bryoflora.

Introduction

The knowledge about the bryoflora of Iran remains meager. Kürschner (1996) added 15 taxa to the Iranian bryoflora, and Kürschner *et al.* (2000) published an updated list of 121 taxa from the Golestan National Park (NE Iran) including eight new species. Akhani and Kürschner (2004) prepared an annotated checklist of the Iranian bryoflora including 437 taxa (two hornworts, 68 liverworts and 367 mosses). Kürschner (2006, 2007, 2008) constructed keys for the identification of mosses of the near and middle east. Frey and Kürschner (2010) added 42 records to the bryoflora of Iran. Kürschner and Frey (2011) published a comprehensive report on the bryophyte flora of Southwest Asia. Zare *et al.* (2011) recorded eighteen new mosses from the Hyrcanian forest region (N Iran). Fereidounfar *et al.* (2011) reported *Syntrichia norvegica* F.Web. from Alvand mountains in Hamedan province (W Iran), Shirzadian (2011, 2012), and Shirzadian and Akhoondi (2011) made significant contribution with the records of many new additions to the bryophyte flora of Iran.

In the present study, seven species of mosses namely *Bryum algovicum* Sendtn. ex Müll.Hal., *B. creberrimum* Taylor, *B. klinggraeffi* Schimp., *B. mildeanum* Jur. (Bryaceae), *Grimmia plagiopodia* Hedw. (Grimmiaceae), *Orthotrichum rivulare* Turner (Orthotrichaceae) and *Didymodon sinuosus* (Mitt.) Delogne, (Pottiaceae) are newly recorded from Iran.

Methods

Geographic context

Mazandaran province which embraces Hyrcanian forest, has a richness of biological and cultural diversity, with endemic and endangered species and a diverse range of economic and social conditions. This summergreen broad-leaved forest reaches up to an altitude of 2600 m and located in north of Iran at the southern Caspian coast. Rainfall averages between 1420–1530 mm per annum, with the heaviest precipitation in the

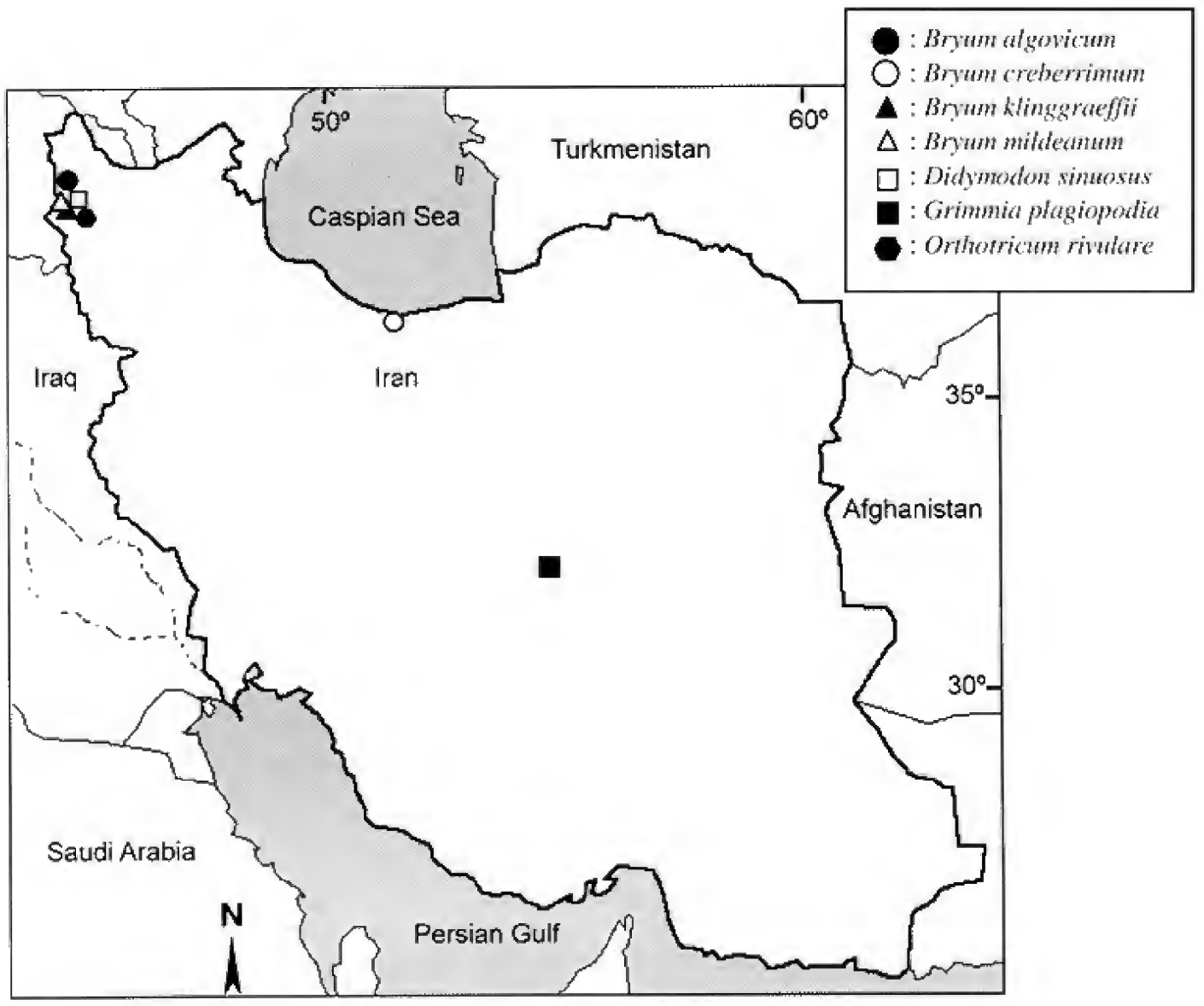

Fig. 1. Distribution map of new records of mosses from Iran.

summer. Temperatures are moderate, ranging from a few below 0° C in December to February to +25° C during the summer. West Azerbaijan province is humid, with mean rainfall of about 350 mm with the maximum mean temperature of 28.3° C in August and the minimum mean monthly temperature of -5° C in January. In contrary, Yazd province is a kind of desert land of centre of Iran, which has a much drier climate. Mean monthly temperature reaches 41° C in July and -4.4° C in January. The total annual rainfall is ca 60 mm, the minimum c. 0.3 mm in May and maximum c. 18 mm in March (Hosseini *et al.* 2012).

Field visits were made in different seasons in 2012 in West Azerbaijan, Mazandaran and Yazd provinces of Iran (Fig. 1). The samples of mosses were collected in paper bags and field data were recorded. The samples were air-dried in room temperature and stored in the standard paper packet. For morphological observations, the samples were soaked in water for a few minutes for their revival. The whole leaf and peristome mounts were observed under the microscope (Olympus-BH2) and photographed. Identification of samples was made with the help of Smith (2004), Gallego (2005) and Kürschner and Frey (2011) following the classification of Goffinet *at al.* (2009). The voucher specimens are preserved in the herbarium of the Ministry of Jihad-e-Agriculture ("IRAN") at the Iranian Research Institute of Plant Protection (Tehran, Iran).

Results and Discussion

Bryaceae

Iranian bryoflora includes 26 species of *Bryum* (Kürschner and Frey 2011, Akhani and Kürschner 2004). Here, we add four species of *Bryum* species to the Iranian bryoflora:

Bryum algovicum Sendtn. ex Müll.Hal. (Fig. 2)

This species is characterized by its pyriform capsule and exostome with vertical or oblique lines joining transverse articulations. The spore size ranges from 28 to 34 μm. On the basis of the colour of basal laminal cells, *Bryum algovicum* differs from its close associate *B. uliginosum,* as in the former the basal laminal cells are reddish while in the latter, these cells have same colour as the other lamina cells (Kürschner and Frey 2011). We found some fertile specimens growing on basic sandy soil in open places, and sporophytic characters helped in distinguishing it from its closely related species. *B. algovicum* has been reported from Afghanistan, Turkey, and Syria (Kürschner and Frey 2011) where it grows on sand-dunes, basic cliff ledges, rock crevices, and quarries.

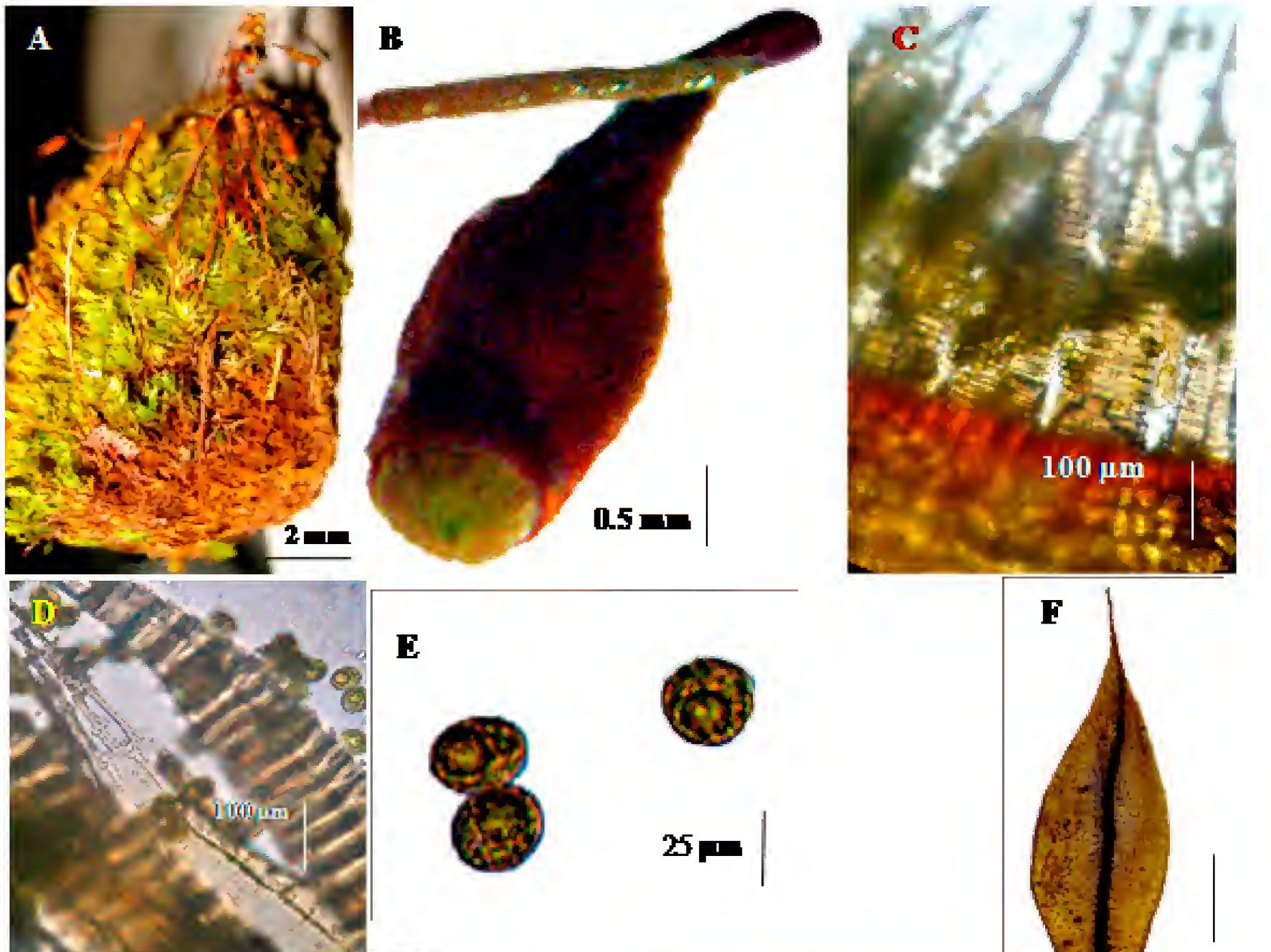

Fig. 2. *Bryum algovicum*: **A.** habit; **B.** capsule without operculum; **C.** outer surface of exostome teeth; **D.** outer surface of endostome tooth; **E.** spores; **F.** leaf; **G.** upper laminal cells; **H.** basal cells.

Specimen examined: Iran: West Azerbaijan province, Orumieh, Movana, Jermi, near Turkey border, on soil, 37˚25' N, 44˚43'E, 1860 m, 20 Jun 2012, *M. Eskandari* (IRAN 0459 B).

Bryum creberrimum Taylor (Fig. 3)

This species is distinguished by ovate-lanceolate leaves and peristome with perforations as long as wide. *Bryum creberrimum* is closely related to *B. pallescens* Schleich. ex Schwägr. (Smith 2004). The minor differences are that, the former has smaller spores, widely perforated processes and lanceolate leaves while the latter is reported to have comparatively larger spores and ± ovate, shortly pointed leaves. Spence (2005) transferred *B. creberrimum* from *Bryum* to *Ptychostomum*, while Kürschner and Frey (2011) retained it in the genus *Bryum*.

Bryum creberrimum has been recorded from Afghanistan, Sinai Peninsula (Egypt) and Turkey in the southwest Asia (Kürschner and Frey 2011).

Specimen examined: Iran: Mazandaran province, Nowshahr, 10 km to Sisangan, Poshtovan, on stone near small stream, 36°36'N, 51°41'E, -15 m, 01 Apr 2013, *S. Shirzadian* (IRAN 0460 B).

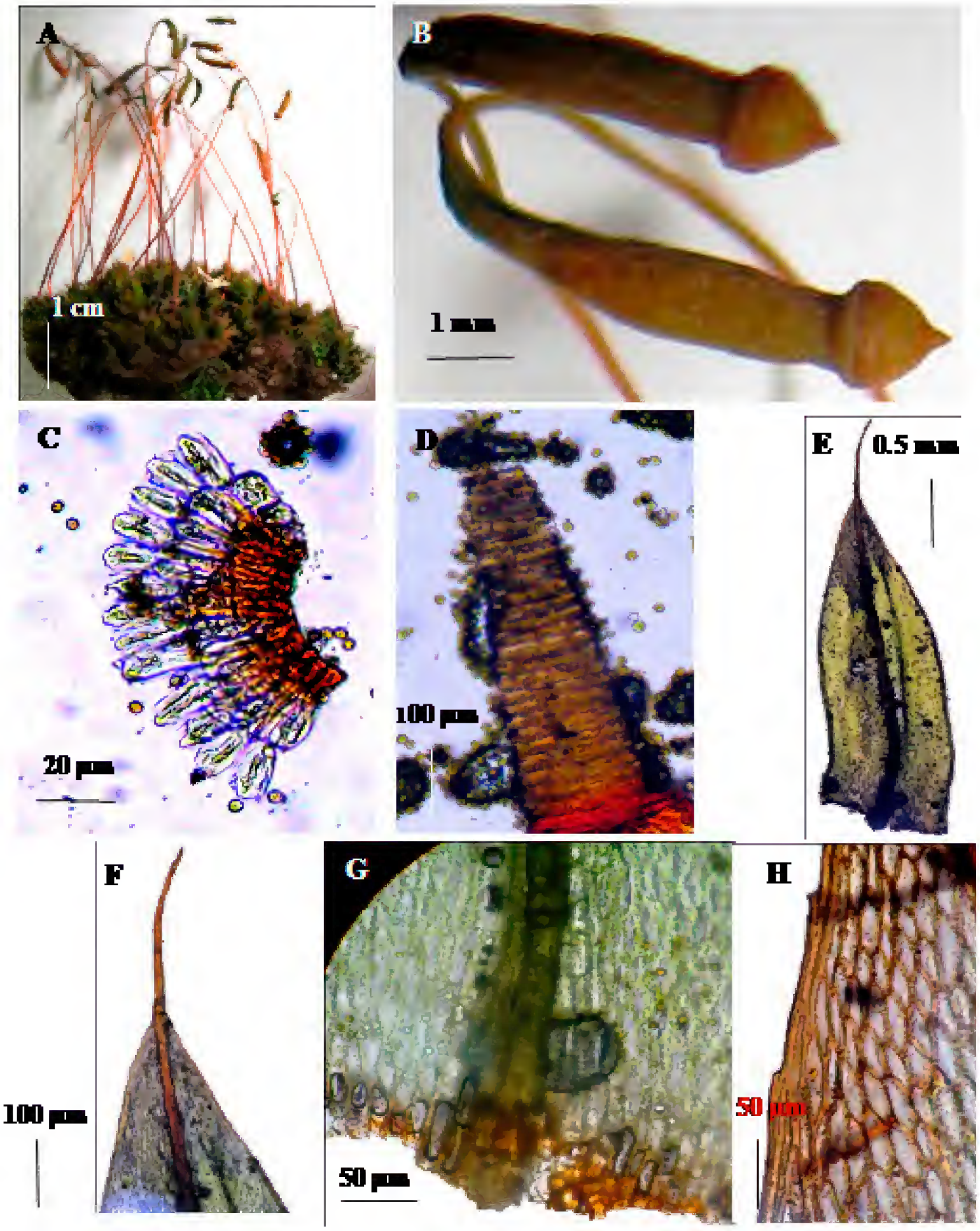

Fig. 3. *Bryum creberrimum*: **A**. habit; **B**. capsule; **C**. annulus; **D**. outer surface of exostome tooth; **E**. leaf; **F**. upper laminal cells; **G**. basal cells; **H**. corner cells.

Bryum klinggraeffii Schimp. (Fig. 4)

This species is characterized by acuminate-lanceolate leaves with denticulate apex, excurrent costa and presence of rhizoidal gemmae. *Bryum klinggraeffii* is morphologically similar to *B. violaceum* Crunduw. & Nyholm., but can be distinguished by its bright crimson gemmae ((80-90 µm diameter) on rhizoids while *B. violaceum* possesses purplish-red gemmae ((60-80 µm diameter) on rhizoids (Kürschner and Frey 2011). The leaves of our specimen are broader then those reported by Kürschner and Frey (2011), which might be the effect of local climatic conditions.

Bryum klinggraeffii has been reported from Turkey and United Arab Emirates in southwest Asia (Kürschner and Frey 2011).

Specimen examined: Iran: West Azerbaijan province, Orumieh, Band, Shamlakan, on soil, 37°28'N, 44°59'E, 1730 m, 20 Jun 2012, *M. Eskandari* (IRAN 0461 B).

Bryum mildeanum Jur. (Fig. 5)

This species is characterized by reddish short excurrent costa, thin walled laminal cells and narrowly ellipsoid capsule. Spence (2007) considered this species as *Imbribryum mildeanum* on the basis of its characteristic imbricate leaves, a feature also shared with*B. alpinum* and *B. gemmiparum*. Guerra *et al.* (2008) obtained some new gametophytic and sporophytic characters through SEM and molecular data from two chloroplast DNA regions (trnL-F and trnG) to resolve the circumscription of these taxa and concluded that *B. mildeanum* and *B. alpinum* form independent lineages,both separated from *B. gemmiparum*.

Bryum mildeanum has been recorded from Lebanon and Turkey in southwest Asia (Kürschner and Frey 2011).

Specimen examined: Iran: West Azerbaijan province, Orumieh, Movana, Bani, on soil near river, 37°37'N, 44°41'E, 1600 m, 20 Jun 2012, *M. Eskandari* (IRAN 0462 B).

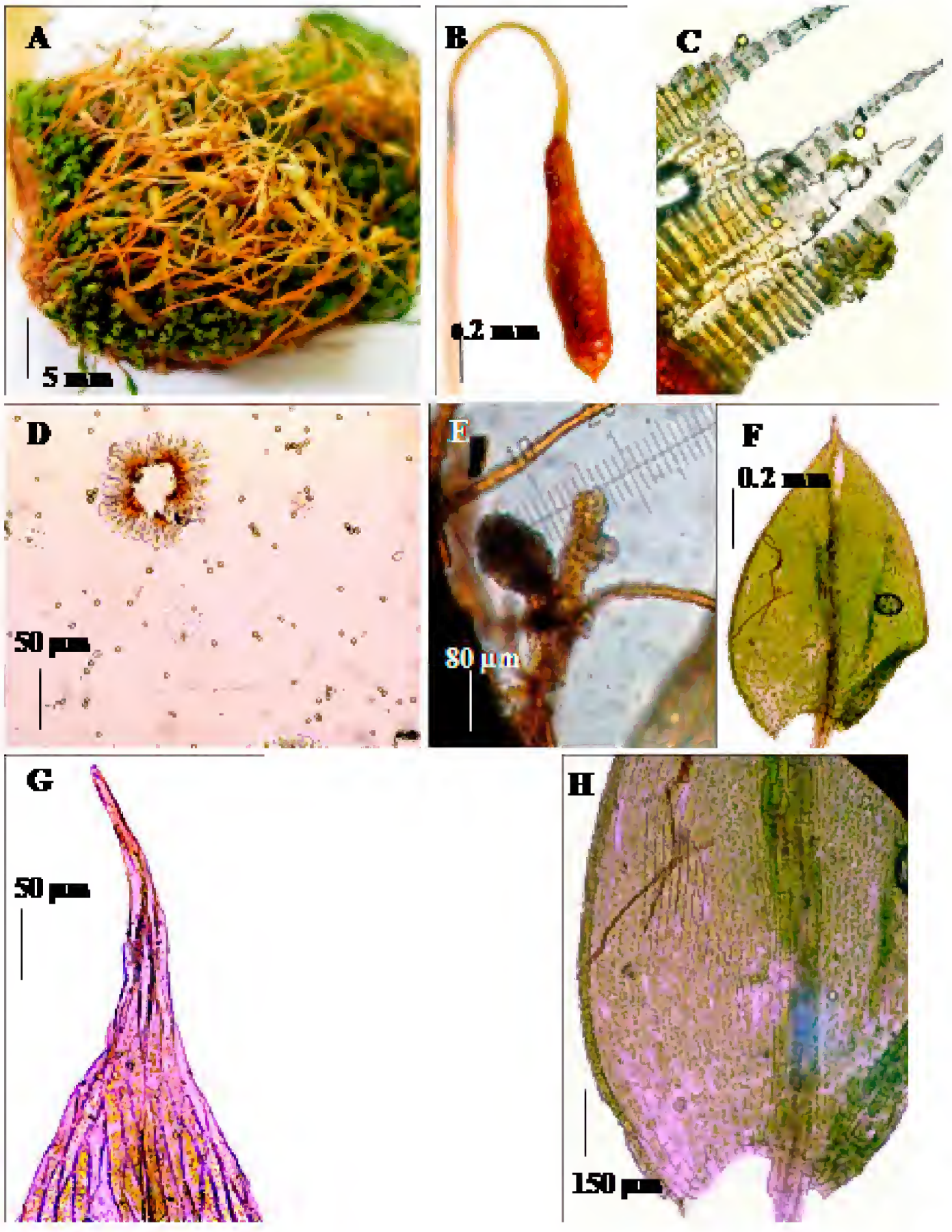

Fig. 4. *Bryum klinggraeffii*: **A.** habit; **B.** capsule; **C.** peristome teeth; **D.** annulus and spores; **E.** rhizoidal gemmae; **F.** leaf; **G.** upper laminal cells; **H.** basal and median cells.

Grimmiaceae

There are 15 species of *Grimmia* Hedw. recorded from Iran. Present collection of *Grimmia plagiopodia* Hedw. is first report in Iran.

Grimmia plagiopodia Hedw. (Fig. 6)

This species is characterized by brown-green plant with white leaf tips and mamillose operculum. *Grimmia plagiopodia* is compared with its close associate *G. crinita* Brid. and distinguished it by straight leaves in dry conditions, roundish and smooth capsule and mamillose operculum (Kürschner and Frey 2011).

This species has been reported from Afghanistan, Iraq, and Turkey in southwest Asia (Kürschner and Frey 2011).

Specimen examined: Iran: Yazd province, Tezerjan, on stone, 31°34'N, 54°27'E, 2300 m, 17 May 2012, *S.A. Ismailzadeh* (IRAN 0463 B).

Orthotrichaceae

Nine species of *Orthotrichum* are recorded from Iran (Kürschner and Frey 2011). The present record of *Orthotrichum rivulare* is a new addition to the moss flora of Iran.

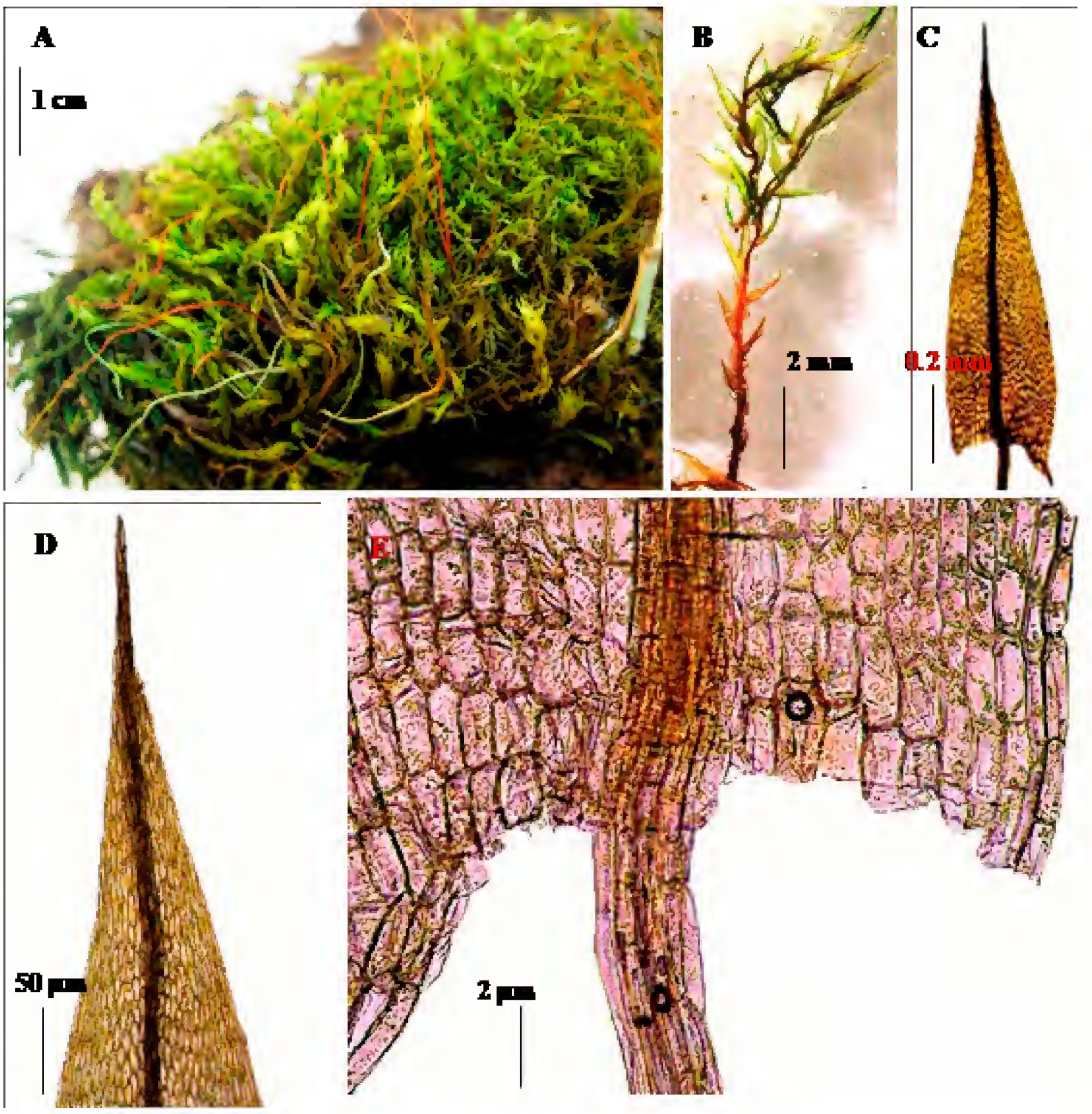

Fig. 5. *Bryum mildeanum*: **A.** dry habit; **B.** moist habit; **C.** leaf; **D.** upper laminal cells; **E.** basal laminal cells.

Orthotrichum rivulare Turner (Fig. 7 A–C)

This is a hygrophytic species that previously reported from North America, Europe and Western Turkey (Kürschner and Frey 2011). It belongs to subgenus *Pulchella* and is characterized by the ovate-lanceolate to obtuse leaves, with irregularly dentate apex and plicate, smooth calyptra (Erdag & Kürschner, 2002). The light brown sporophyte and eight recurved exostome teeth are however, similar to those of *O. affine* (Bosanquet 2009).

Specimen examined: Iran: West Azerbaijan province, Orumieh, Band, Shamlakan, on soil, 37°28'N, 44°59'E, 1730 m, 20 Jun 2012, *M. Eskandari* (IRAN 0465 B).

Pottiaceae

There are 14 species of *Didymodon* reported from Iran ((Kürschner and Frey 2011) and present record of *Didymodon sinuosus* is a new addition to the bryoflora of Iran.

Didymodon sinuosus (Mitt.) Delogne (Fig. 7 D–G)

This species is characterized by its fragile leaf apex and sinuose leaf margins. Leaf apices in this species are often missing and this character separates *Didymodon sinuosus* from other species (Kürschner and Frey 2011). *Didymodon sinuosus* is distinguished from a closely related species *D. tophaceus* (Brid.) Lisa by its imbricate leaves in dry condition, broad ovate leaves, costa with ± hexagonal

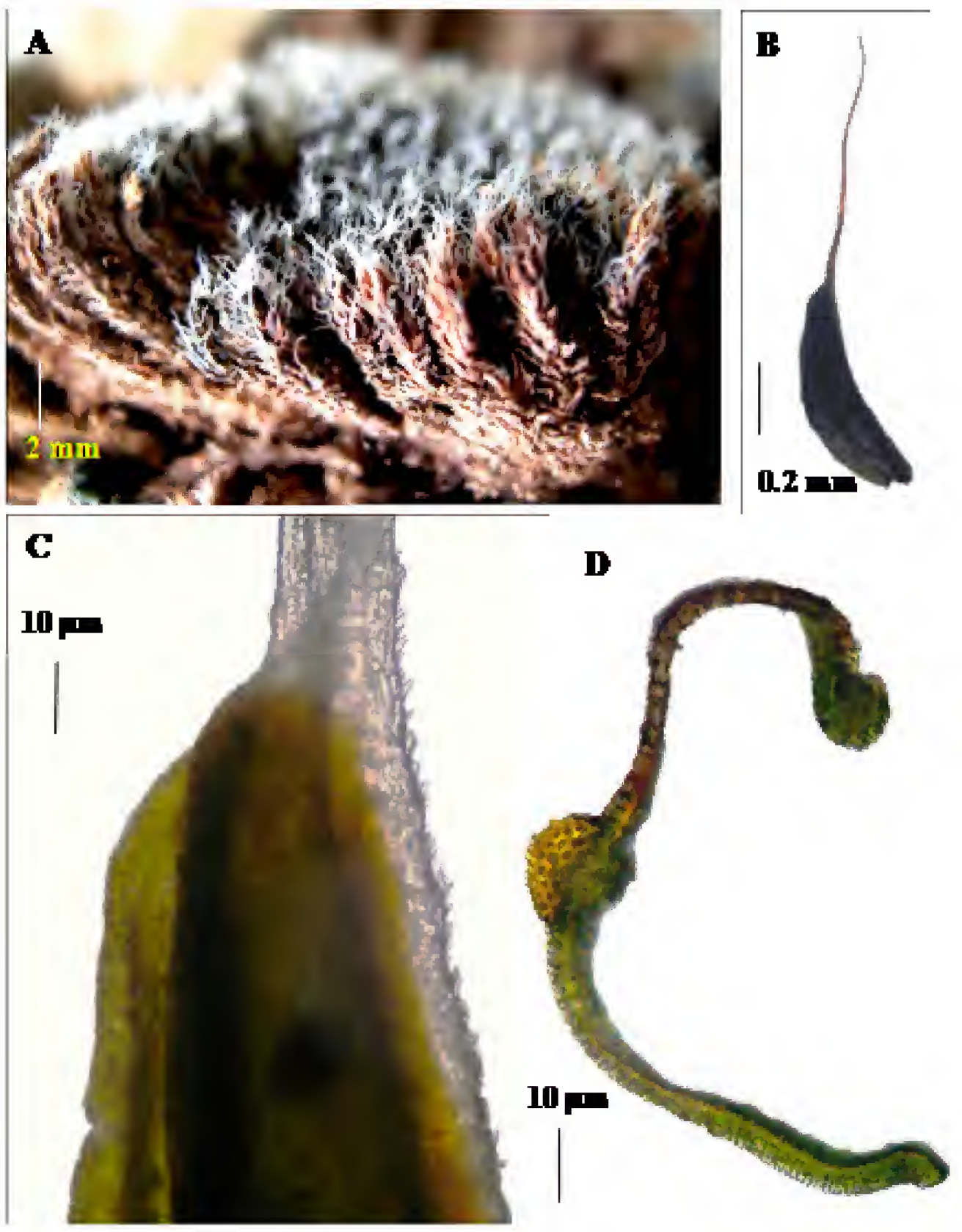

Fig. 6. *Grimmia plagiopodia*: **A**. habit; **B**. leaf; **C**. upper laminal cells; **D**. leaf cross section.

adaxial cells and the smooth lamina cells. Its another close relative *Didymodon cordatus* Jur. is distinguishable by its wider costa and axillary gemmae. According to Smith (2004), *D. sinuosus* is found on damp shaded usually basic rocks by streams and rivers and also in sheltered habitats on walls and old buildings, among tree roots in woodland. Kürschner and Frey (2011) have reported it from Lebanon, and Turkey in southwest Asia.

Specimen examined: Iran: West Azerbaijan province, Orumieh, Band, Shamlakan, on soil, 37°28'N, 44°59'E, 1730 m, 20 Jun 2012, *M. Eskandari* (IRAN 0466 B).

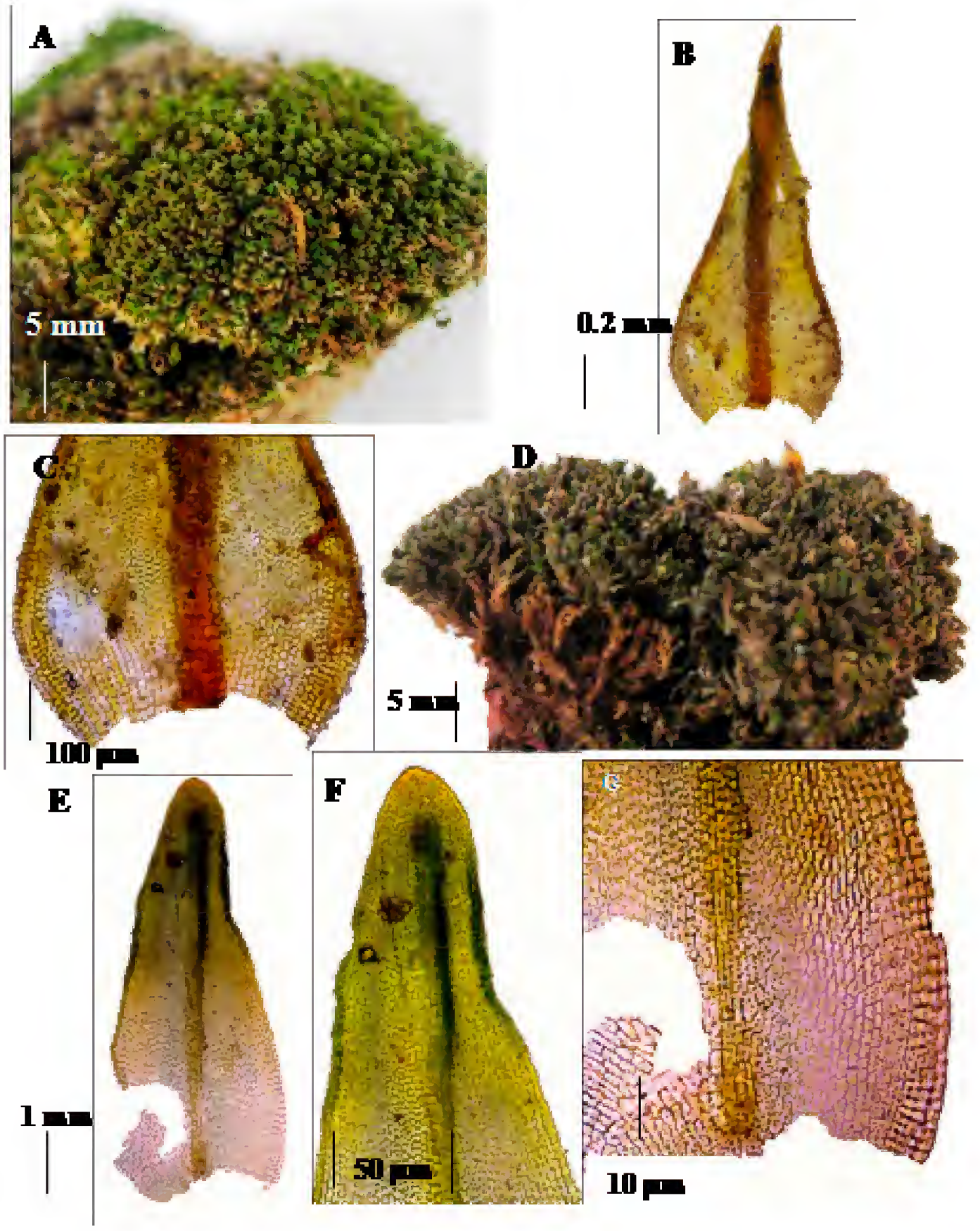

Fig. 7. *Didymodon sinuosus*: **A**. habit; **B**. leaf; **C**. lower laminal cells; *Orthotrichum rivulare*: **D**. habit; **E**. leaf; **F**. upper laminal cells; **G**. lower laminal cells.

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Unlocking collections: New records of Lepidoziaceae (Marchantiophyta) for the islands of Fiji.

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Abstract

It is clearly evident that the bryophyte flora of the islands of Fiji remains inadequately documented. Here, five liverwort species of Lepidoziaceae are reported as new to the Republic of Fiji: *Lepidozia haskarliana*, *Neolepidozia cuneifolia*, *N. wallichiana*, *Telaranea major* and *Tricholepidozia melanesica*.

Introduction

Conservation International identified all the islands of Micronesia and Polynesia, including the islands of Fiji, as the Polynesia-Micronesia hotspot, one of thirty-five global biodiversity hotspots in the world (Mittermeier et al. 2005). Fiji consists of over 300 islands of varying sizes with an aggregate land area of about 18,300 km^2 as well as many smaller islets and off-shore rocks (Department of the Environment 1997). Alarmingly, Conservation International recognized this hotspot as having one of the highest extinction rates in the world. In 2011, von Konrat and colleagues provided an overview of the state of floristic knowledge of Fijian liverworts at that time, noting that very few publications have focused solely on collections from Fiji (von Konrat et al. 2011). However, in the last decade, there has been increased interest in the Fijian liverwort flora, e.g., Pócs (2008a, b), Pócs et al. (2011), Söderström et al. (2011) and field programs have been supported by a variety of agencies and foundations (von Konrat et al. 2011). This paper reports five new records of Lepidoziaceae collected on joint expeditions since 2008, which included Dr. Elizabeth A. Brown, who was not only an avid collector in the field, but who also played an instrumental role in expedition logistics and was a great companion to all. This paper is dedicated to her in memory of her expertise, passion and interest in Lepidoziaceae, and especially her pioneering molecular investigations into the family.

Heslewood and Brown (2007) carried out the first molecular investigation of the family and indicated that taxonomic concepts of a number of subfamilies and genera required reassessment. Subsequently, Cooper et al. (2011) expanded that initial study incorporating sequences from 10 loci to estimate the phylogeny of 93 species from Lepidoziaceae. Their study provided strong molecular evidence against the monophyly of three subfamilies; Lepidozioideae, Lembidioideae and Zoopsidoideae, and seven of the 20 sampled genera, including *Lepidozia*, *Telaranea*, *Kurzia*, *Zoopsis*, *Lembidium*, *Paracromastigum* and *Chloranthelia*. Together with a detailed investigation of the Lepidozioideae (Cooper et al. 2012), these phylogenetic studies formed the basis of an interim classification provided by Cooper (2013), in which *Neolepidozia* and *Tricholepidozia* were reinstated and a new genus, *Ceramanus* (Cooper et al. 2013), recognized. Although a number of uncertainties remain, as emphasised by Cooper (2013), we follow the classification and concepts of that paper, which also follows the classification of the forthcoming worldwide first ever worldwide checklist of liverworts and hornworts (Söderström et al. 2012). While this is not itself without contention, the second author (JE) adheres to the intrafamilial classification of Lepidoziaceae given in Engel and Glenny (2008), these differences of opinion do not impact upon the new records reported here. In this paper we have focused on species of the subfamilies Lepidozioideae and Zoopsidoideae for Fiji. The subfamily, Bazzanioideae, which includes the species rich genus *Bazzania*, still requires further investigation.

The new reports for Fiji are not surprising, as these species have been reported from neighbouring Vanuatu and elsewhere in the Southwest Pacific. Similar patterns have been well documented for many seed plants throughout Melanesia (Heads 2006). However, a thorough investigation of Lepidoziaceae from this region is required and may perhaps uncover over-inflated species numbers as well as reveal as yet undescribed taxa in the region.

This paper also underscores the critical importance of herbaria as reservoirs of undescribed and undocumented diversity (Bebber et al. 2010). Herbarium-based taxonomic research activity has a pivotal role in the documentation of the world's flora and there is an urgent need for widened access to global collections through specimen exchange and the large scale digitization of existing specimens (Wheeler 2008). This is exemplified by the important contribution the private herbarium of the esteemed bryologist Rudolf M. Schuster made to the present study. This collection, which contains historical collections from Fiji dating back to 1968, was recently transferred to The Field Museum (F).

Methodology and materials

All specimens were identified by M. von Konrat and J. Engel in consultation with other authors. John Engel (second author) also has seen most of the type specimens associated with these new reports as part of a previous study (Engel and Merrill 2004). Herbarium acronyms follow Holmgren and Holmgren (2003). All specimens are deposited in F, with duplicates in SUVA and NSW. For many taxa the distribution has been extracted from the Early Land Plant Today (ELPT, http://elpt.fieldmuseum.org/) databases of Söderström and Hagborg to supplement cited literature; the distribution and mapping of ELPT is described by von Konrat et al. (2010). Type details are also derived from the ELPT project unless otherwise stated. Digital images were taken using an Olympus BHS22 compound microscope and a Wild stereo microscope both equipped with JENOPTIK ProgRes C3 and C5 (Jena, Germany) digital cameras; images were stacked using Zerene Stacker Professional Edition.

New records for the islands of Fiji

Lepidozia haskarliana (Gottsche, Lindenb. & Nees) Steph., *Species Hepaticarum* 3: 614 (1909). **Fig. 1**

Basionym: *Lepidozia supradecomposita* β *haskarliana* Gottsche, Lindenb. & Nees, *Synopsis Hepaticarum, fasc. 2*: 202 (1845).

Type citation: "Habitat in montosis regionis orientalis et australis districtus Bantam Javae insulae (Blume et Hasskarl in Hb. N., L. et Lg.)".

Illustrations: Mizutani (1968: 153), Fig. I13–25; Piippo (1984: 323), Fig. 8c–j.

Specimens examined: Fiji: Viti Levu: Mt. Tomanivi, summit area, in mossy "elfin" woodland, 3900–4300 ft, 2 Jul 1967, *R.M. Schuster 67-7924* (F-C0312489F); Mt. Tomanivi, summit area, c. 2.5–3 miles E of Navai, in wet, dense rain forest, associated with *Psiloclada*, *Herberta*, *Plagiochila*, *Bazzania* sp. (*R.M. Schuster 56454a, b, c*), 17°38' S, 178° E, 4200–4300 ft, 2 Jul 1967, *R. M. Schuster 56454d* (F-C0312490F); Mt. Tomanivi, summit, c. 2.5-3 miles E of Navai, in wet, dense rain forest, 17°38' S, 178° E, 4200–430 ft, 2 Jul 1967, *R. M. Schuster 56440a*, (F-C0312491F); Mt. Tomanivi, summit, c. 2.5–3 miles E of Navai, in wet, dense rain forest, 17°38' S, 178° E, 4200–4300 ft, 2 Jul 1967, *R.M. Schuster 56440*

(F-C0312492F); Mt. Tomanivi, summit, in mossy "elfin" woodland, 3900–4300 ft, 2 Jul 1967, *R. M. Schuster 67-7952* (F-C0312493F); Mt. Tomanivi, along ridge line near summit area, cloud forest, on bryophyte-covered floor, 1400 m, 18 Apr 2008, *M. von Konrat 4351 & A. Naikatini* (F-C0312494F); Rairaimatuku Plateau, accessed from road near a telecommunication tower, 16 km S of Monasavu, cloud forest, 17°47'31" S, 178°01'13.9" E, 1260 m, 15 Apr 2008, *M. von Konrat 4120* (F-C0312495F), at base of trunk of *Calophyllum*; Naitasiri Prov., Rairaimatuku Plateau, accessed from path near a telecommunication tower, 17°47'31" S, 178°01'13.9" E, 1260 m, 3 Sep 2011, *L. Briscoe 11/093* (F); Rairaimatuku Plateau, on trunk of tree fern, 17°47'31.74" S, 178°00'32.22" E, 1265 m, 17 Oct 2012, *M. Katafono M-332-B* (SUVA); Rairaimatuku Plateau, accessed from road near a telecommunication tower, 16 km S of Monasavu, cloud forest, 17°47'31" S, 178°01'13.9" E, 1260 m, 15 Apr 2008, *M. von Konrat 4117* (F-C0312496F), forming large loose mats on ground under dense vegetation at base of *Blechnum*-covered bank; Nabukelevu mountain above Nadakuni Village and between Waiaboa Stream and Sovi Basin, S 17°56'59" S, 178°16'16" E, 720 m, 1 Sep 2011, *M.A.M. Renner 5507, M. von Konrat & F. Rakoro* (NSW880391), forming black, wiry, loose mats in partial shade on rock at base of bluff with NE aspect.

Recognition: The plants are easily recognized in the field, appearing distinctly wire-like or filiform (Fig. 1) sometimes forming conspicuous, moderately sized, loose mats (up to 15 cm diam.). The leaves are very small, more or less as wide as the stems, appearing almost scale-like, and very widely separated from each other. There are several *Lepidozia* species in Australasia and Melanesia with the filiform branching and minute

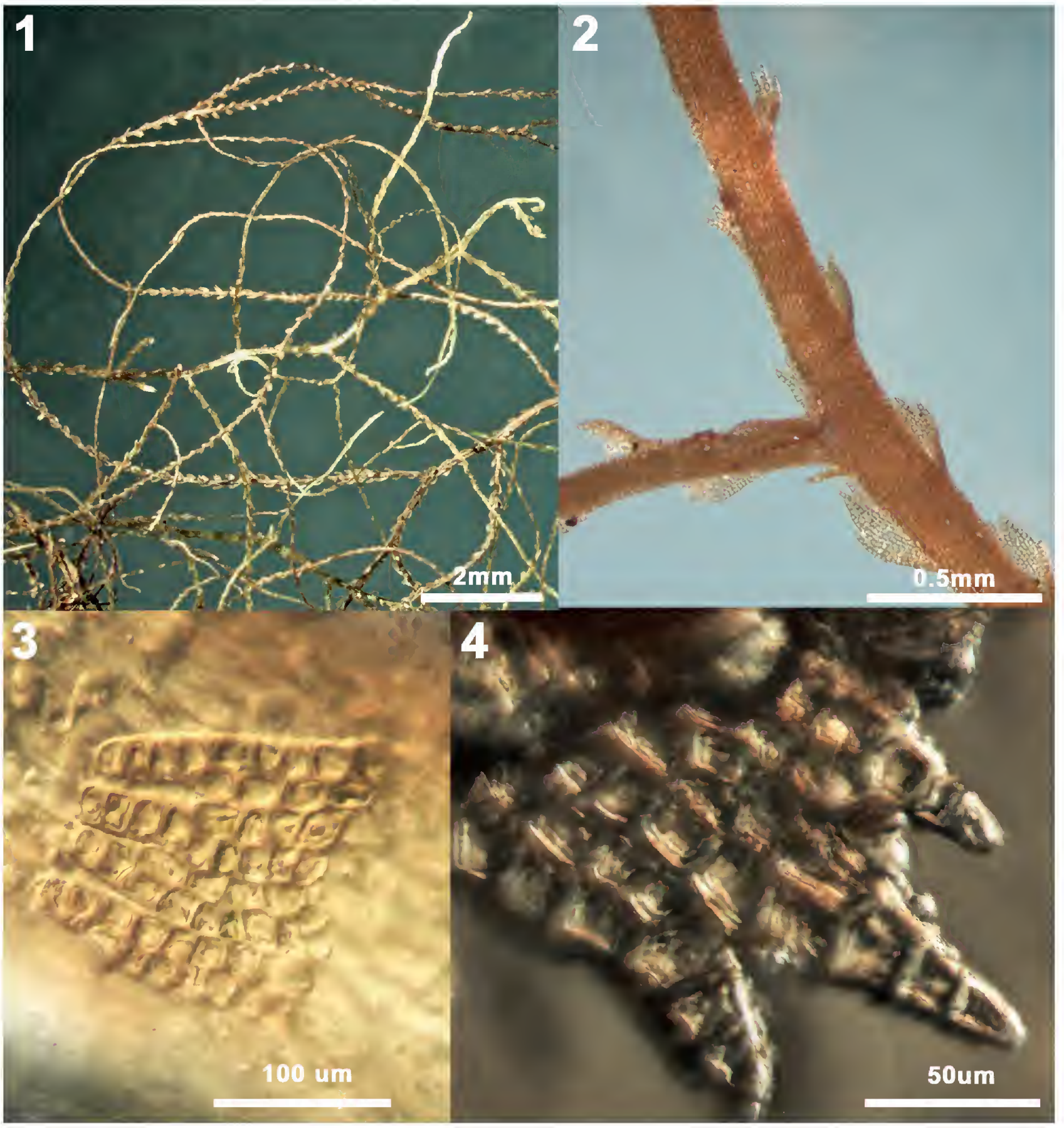

Fig. 1. *Lepidozia haskarliana* (Gottsche, Lindenb. & Nees) Steph., **1**. plant habit. **2**. scale-like leaves in relation to stem. **3**. underleaf, less than the width of the stem. **4**. stem leaf. All from *M. von Konrat 4351 & A. Naikatini*

leaves. In Melanesia there are at least five species with this distinctive vegetative form (Piippo 1984). *Lepidozia haskarliana* can be distinguished from these by the combination of the subrectangular stem leaves that are 3 or 4 lobed and the branch underleaves narrower than the stem.

Distribution: *Lepidozia haskarliana* was previously reported from Malaysia (Sabah), Indonesia (Jawa, Seram, Maluku, Papua), Philippines (Luzon, Negros), Papua New Guinea and the Solomon Islands (Grolle and Piippo 1984; Piippo 1984; ELPT database). Here it is reported for Fiji from Viti Levu.

Habitat: *Lepidozia haskarliana* would appear to be a relatively common plant in areas of high precipitation, particularly in "mossy" cloud forests or moist habitats where it inhabits deeply to moderately shaded habitats

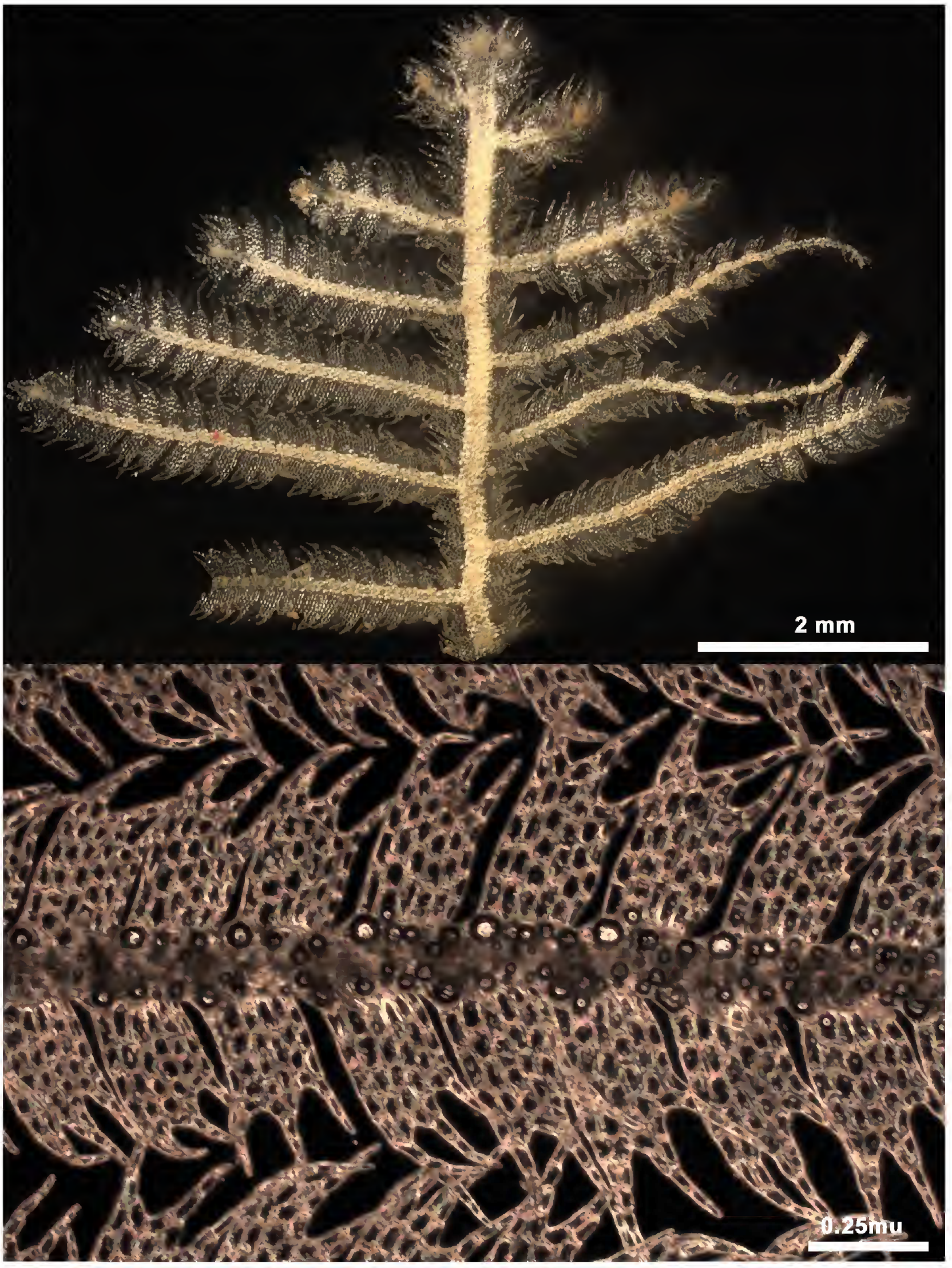

Fig. 2. *Neolepidozia cuneifolia* (Steph.) Fulford & J.Taylor, **1**. plant habit. **2**. lateral branches showing subfalcate branch leaves. All from *M. von Konrat 12341, M. Katafono, B. Shaw & A. Naikatini.*

on the forest floor. It has been found growing at the base of tree trunks or under dense vegetation and appears to be particularly common in cloud forests of summit areas.

Neolepidozia cuneifolia (Steph.) Fulford & J.Taylor, *Brittonia* 11: 85 (1959). **Figs 2, 3**

Basionym: *Lepidozia cuneifolia* Steph., *Species Hepaticarum* 3: 612 (1909).

Type citation: PAPUA NEW GUINEA. Moresby: in montosis Moroka, 1300 m, 1893, *Loria*, in Herb. Levier.

Lectotype (Cooper et al. 2013): PAPUA NEW GUINEA: Central (Womersley 1978): Port Moresby: Mount Moroka (Astrolabe Range), 1300 m, anno 1893, *Loria s.n.*, in Herb. Stephani 11916 (G69618).

Illustration: Piippo (1984: 315), Figs 4c, f, h, j.

Specimens examined: Fiji: Vanua Levu: Waisali Dakua National Trust Forest Reserve, in gully of *Agathis* forest, 12 Jul 2006, *M. von Konrat 06/9-3, J. Braggins & A. Naikatini*, on soil of stream margin (F-C0312503F); Waisali Dakua National Trust Forest Reserve, in gully of *Agathis* forest, 2 May 2012, *M. von Konrat 12341, M. Katafono, B. Shaw & A. Naikatini*, on soil of stream margin (F-C0312515F).

Recognition: Engel and Merrill (2004) provided a detailed account distinguishing between *Neolepidozia cuneifolia* and a morphologically very similar taxon, *N. wallichiana*. One chief difference is that the branch leaves are subfalcate and asymmetrically lobed in *Neolepidozia cuneifolia* and have a disc of up to 8 cells high in the Fijian plants (Figs 2, 3) whereas *N. wallichiana* has a disc less than 8 cells high and more or less symmetrically lobed (Fig. 4). One feature that has not been described is that the branch underleaves are always bilobed in *N. cuneifolia* whereas they are (2 or) 3 or 4 lobed in *N. wallichiana*. Material was also examined from Papua New Guinea where these features seemed to be consistent.

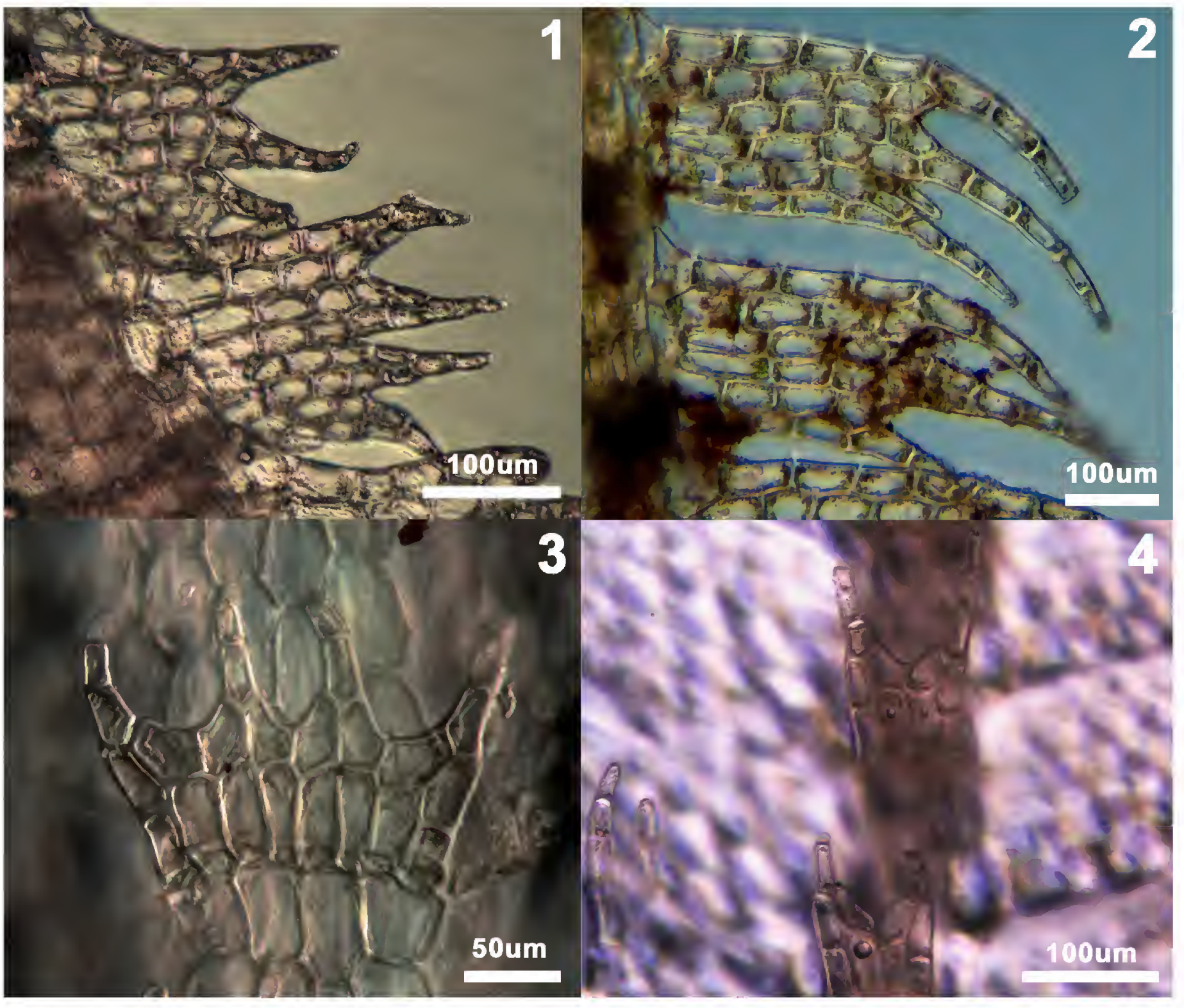

Fig. 3. *Neolepidozia cuneifolia* (Steph.) Fulford & J.Taylor, **1**. main stem leaves with 4 lobes. **2**. subfalcate branch leaves. **3**. stem underleaf, 4-lobed. **4**. branch underleaf, 2-lobed. All from *M. von Konrat 12341, M. Katafono, B. Shaw & A. Naikatini*.

Distribution: The species has previously been reported for Indonesia (Ambon, Maluku), Papua New Guinea New Caledonia, Vanuatu and Tahiti (Engel and Merrill 2004) and its distribution is extended here to Fiji, from the highlands of Vanua Levu.

Habitat: The habitat preference of this species is similar to many *Neolepidozia* species growing in moist habitats, often on trunks of tree ferns, or rotting logs and tree stumps.

Notes: *Neolepidozia cuneifolia* and *N. wallichiana* belong to a species complex (Engel and Merrill 2004). *Neolepidozia cuneifolia* was synonymized by Inoue (1979), who was followed by Piippo (1984), and Grolle and Piippo (1984). On the other hand, Engel and Merrill (2004) retained *Neolepidozia cuneifolia* and *N. wallichiana* as two distinct species as recognized here.

Neolepidozia wallichiana (Gottsche) Fulford & J.Taylor, *Brittonia* 11(2): 84 (1959). **Fig. 4**

Basionym: *Lepidozia wallichiana* Gottsche, *Synopsis Hepaticarum, fasc. 2*: 204 (1845).

Lectotype (Piippo 1984): Nepal: *s. loc.*, without date, *Scouler s.n.*, in Herb. Gourlieano (W4642).

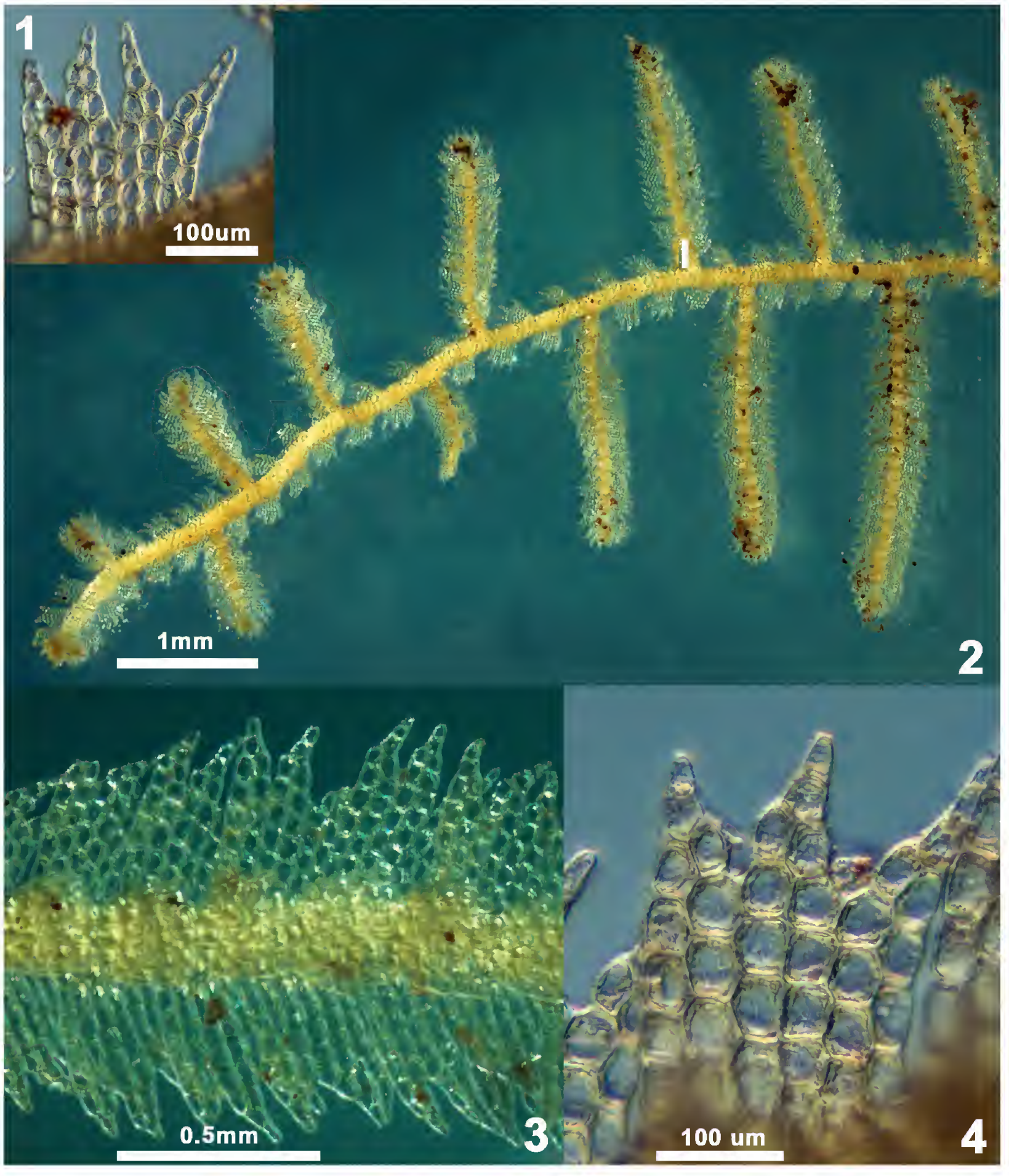

Fig. 4. *Neolepidozia wallichiana* (Gottsche) Fulford & J.Taylor, **1.** stem leaf. **2.** plant habit. **3.** lateral branch leaves. **4.** branch leaf, subrectangular. All from *R. M. Schuster 67-7925*.

Illustrations: Hattori and Mizutani (1958: 87) Fig. III 1–15; Piippo (1984: 315) Fig. 4a–c, e, f, h, j.

Specimens examined: Fiji: Viti Levu: Summit of Mt. Tomanivi, in mossy "elfin" woodland, 3900–4300 ft, associated with *Bazzania* and *Schistochila*, on peaty soil at tree base, 2 Jul 1967, *R.M. Schuster 67-7925* (F-C0312497F); Kadavu: Mt. Nebukalevu, on shaded rock wall in cloud forest, 566 m, 9 Oct 2011, *L. Söderström 2011/212* (TRH).

Recognition: Engel and Merrill (2004) provided a detailed account distinguishing between *Neolepidozia wallichiana* and a morphologically similar taxon, *N. cuneifolia*. The key differences are summarized above under *N. cuneifolia*. Figure 4 illustrates one of the critical differences that Engel and Merrill (2004) recognise with *Neolepidozia wallichiana*, i.e., the more or less symmetrically lobed branch leaves. In contrast, the branch leaves of *N. cuneifolia* are subfalcate and asymmetrically lobed (Figs 2, 3). Engel and Merrill (2004) and Piippo (1984) noted that *Neolepidozia wallichiana* is a widely distributed polymorphic species. However, Engel and Merrill (2004) predicted that rather than a single species a number of distinct taxa are possibly involved and the species complex warrants further investigation.

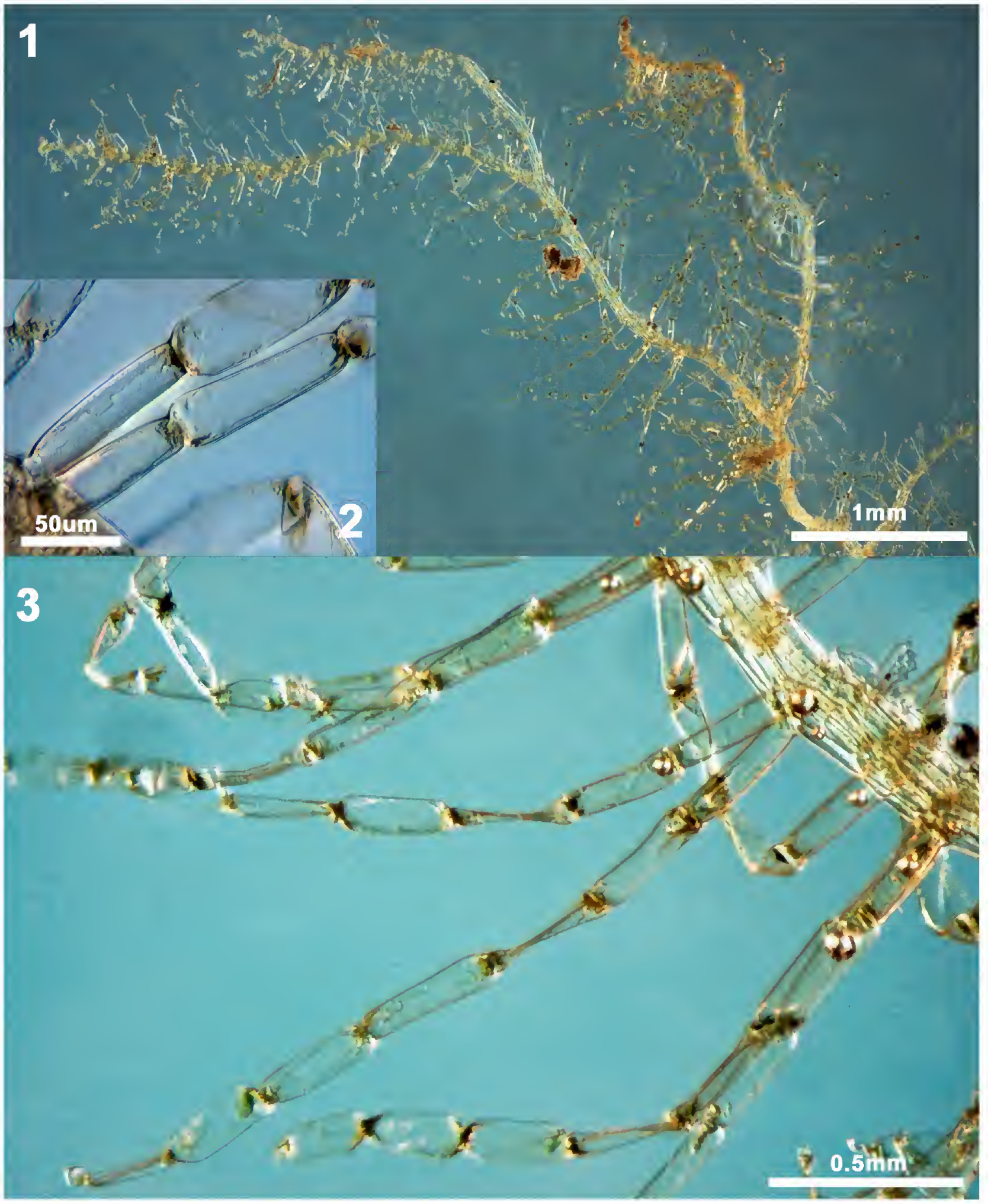

Fig. 5. *Telaranea major* (Herzog) J.J.Engel & G.L.Merr., **1**. plant habit. **2**. base of stem leaf. **3**. bi-lobed stem leaves. All from *M. von Konrat 8908, M. Katafono & S. Tuiwawa*.

Distribution: Engel and Merrill (2004) noted that if the recorded distribution *Neolepidozia wallichiana* (as *Telaranea wallichiana*) is true, then this species has a remarkably wide distribution ranging from the Himalayas to Japan, south to Sri Lanka and the Solomon Islands. However, they noted that published statements of distribution should be re-evaluated upon further investigation of this species complex.

Habitat: This taxon also has a habitat preference similar to many *Neolepidozia* species growing in moist habitats, often on trunks of tree ferns, or rotting logs and tree stumps.

Notes: Söderström et al. (2011) listed *Neolepidozia wallichiana* (as *Telaranea wallichiana*) as doubtful status for Fiji. Söderström et al. (2011) noted that Engel and Merrill (2004) did not acknowledge the taxon growing anywhere in the Pacific, although they did indeed note the Solomon Islands.

Telaranea major (Herzog) J.J.Engel & G.L.Merr., *Fieldiana: Botany (n. ser.)* 44: 165 (2004). **Fig. 5**

Basionym: *Arachniopsis major* Herzog, *Transactions of the British Bryological Society* 1(4): 294 (1950).

Lectotype (Piippo 1984): MALAYSIA: Sarawak: Dulit Ridge, Dulit Trail, c. 800 m, on sandstone rock, *Richards 2579* (JE); isolectotype: MU!

Illustrations: Herzog (1950: 295), Figs 12a–c, 13a, b; Piippo (1984: 171), Fig. 1a, b.

Specimens examined: Fiji: Viti Levu: summit of Mt. Nabukelevu, windswept cloud forest, bryophyte covered floor, 17°56'59" S, 178°16'16" E, 720 m, 1 Sep 2011, *M. von Konrat 8896*, on decorticated log (F-C0312499F); Rairaimatuku Plateau, accessed from road near a telecommunication tower, 16 km S of Monasavu, cloud forest, 17°47'31"S, 178°01'13.9"E, 1260 m, 3 Sep 2011, *M. von Konrat 8908 with M. Katafono & S. Tuiwawa,* on decorticated log (F-C0312500F); Rairaimatuku Plateau, accessed from road near a telecommunication tower, 16 km S of Monasavu, cloud forest, 17°47'31" S, 178°01'13.9" E, 1260 m, 15 Apr 2008, *M. von Konrat 4558*, over dead decaying matter on forest floor (F-C0312501F); Rairaimatuku Plateau, accessed from road near a telecommunication tower, 16 km S of Monasavu, cloud forest including *Metrosideros*, 17°47'31" S, 178°01'13.9" E, 1260 m, 15 Apr 2008, *M. von Konrat 4474*, on dead and decaying matter at base of *Metrosideros* (F-C0312502F).

Recognition: The plant forms soft, velvet-like fine mats similar to *Neolepidozia* species in Fiji, but is immediately recognized under the hand lens by the bilobed stem leaves. The lobes form a uniseriate row up to 8 cells long (Fig. 5). The plants are similar to another species that is bilobed, *Telaranea rosarioana* H.A.Mill., originally described from Vanuatu, and reported in Fiji by Pócs et al. (2011). However, the leaf lobes of *Telaranea major*

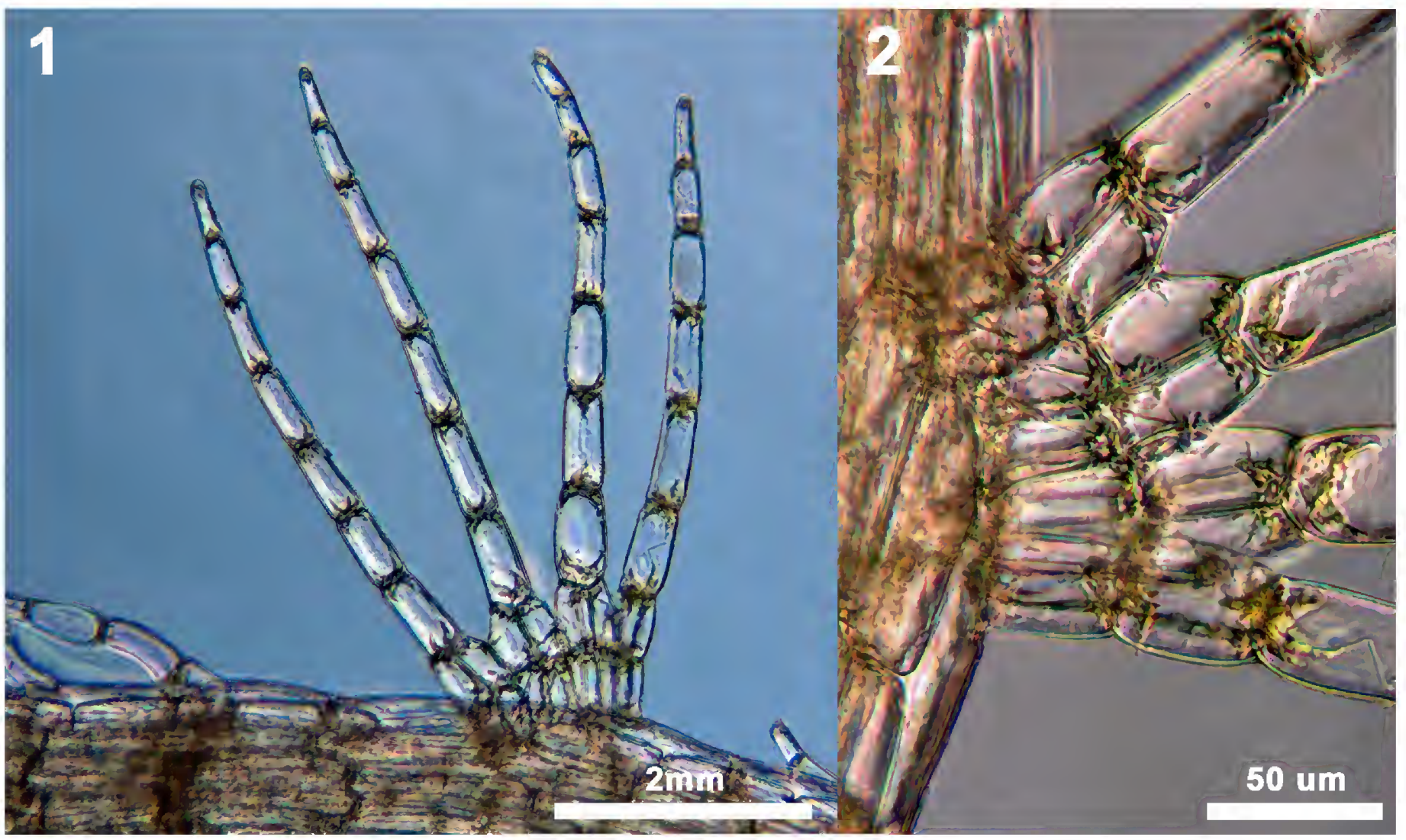

Fig. 6. *Tricholepidozia melanesica* (H.A.Mill.) E.D.Cooper, **1**. stem leaf, 4-lobed. **2**. stem leaf, disc, 2 cells high. All from *R. M. Schuster 67-7977b*.

are smooth, uniseriate throughout and lacking a disc, whereas the lobes of *Telaranea rosarioana* are united for about 0.5–0.7 times their length and have a small disc as well as a punctate leaf surface (Engel and Merrill 2004; Pócs et al. (2011).

Distribution: *Telaranea major* has a broad distribution ranging from Sri Lanka, Malaysia (peninsular Malaysia, Sarawak, Sabah), Indonesia (Sulawesi, Maluku – Ceram, Papua), Philippines (Negros), Papua New Guinea, and Vanuatu (Engel and Merrill 2004; ELPT database).

Habitat: In montane or cloud forests often on trunks of tree ferns appearing at summit areas that capture cloud and high precipitation above 700 m in elevation.

Notes: The species was also discussed by Engel and Merrill (2004).

Tricholepidozia melanesica (H.A.Mill.) E.D.Cooper, *Phytotaxa* 92(2): 60 (2013). **Fig. 6**

Basionym: *Telaranea melanesica* H.A.Mill., *Journal of Bryology 14*: 237 (1986) (Miller 1986).

Type: VANUATU: Erromango: Mt. Fedmoghum, c. 630 m, *Miller 15157* (holotype MU!)

Illustrations: Miller (1986: 238, 241), Figs 3a–f, 4a–c.

Specimens examined: Fiji: Viti Levu: summit of Mt. Tomanivi, in mossy "elfin" woodland, 3900–4300 ft, 2 Jul 1967, *R.M. Schuster 67-7977b* (F-C0312498F); on the ridge of Rairaimatuku Plateau, 2 km E of Monasavu Dam, shady, very wet elfin forest dominated by *Dicksonia brackenridgei,* on the SW side of a summit, 17°45'21" S, 178°04'09" E, 1050–1070 m, 16 Apr 2008, *M. von Konrat 4600* (F-C0312504F); Monosavu, by the telecommunication tower, on laying tree stem in cloud forest, Oct 4 2011, *L .Söderström 2011/118* (TRH). Kadavu: Namara road, on a very rotten log among vegetation by roadside in disturbed lowland rain forest, 145 m, 7 Oct 2011, *L. Söderström 2011/163* (TRH); Mt. Nebukalevu, on a tree base in cloud forest, 566 m, 9 Oct 2011, *L. Söderström 2011/202* (TRH).

Recognition: In Fiji, *Tricholepidozia melanesica* may be distinguished from other species of the subfamily Lepidozioideae by a combination of the stem leaves with 3 or 4 lobes, the low lying disc of only 2 (or 3) cells high and the 4-lobed stem underleaves (Fig. 6). Miller (1986) provided a further distinction between the purportedly allied taxa, *Tricholepidozia neesii*, *T. bisetula* and *T. jowettiana* of the tropical Pacific. Further investigation is required for the species complex in the region.

Distribution: *Tricholepidozia melanesica* was originally described from Vanuatu by Miller (1986), but Engel and Merrill (2004) erroneously stated it that was endemic to Fiji. Söderström et al. (2011) subsequently excluded it from their checklist of liverworts and hornworts of Fiji. However, plants matching the type and the description of *Tricholepidozia melanesica* are here now documented from the islands of Kadavu and Viti Levu.

Habitat: On large tree roots, rotting logs and found on trunks of the tree fern, *Dicksonia*.

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